particularly valuable in bringing scattered data together in compact form, although opinions may vary as to their interpretation.

A new term of classification is introduced with "Cycadophyta," used to include Pteridosperms (Cycadofilices), Bennettitales, and Cycadales. The author also discredits somewhat the value of the ontogeny of the vascular structures as indicating their phylogeny.—J. M. C.

Osmosis and osmotic pressure.—A revolutionary paper upon the nature of osmosis and osmotic pressure has been published by KAHLENBERG,[33] who gives detailed accounts of his experiments. He shows clearly that whether osmosis will take place or not depends upon the specific relations between the septum and the liquids bathing it. If osmosis occurs these relations determine the magnitude of the pressure and the direction of the main current. There is, he claims, no such thing as a strictly semipermeable membrane, since a minor movement in the reverse direction always occurs, though it is often insignificant or practically negligible. The force concerned in osmotic processes lies not merely in the specific affinities between the solvent and the solutes, but primarily in their relation to the membrane, whether it be called "potential energy of solution," "internal pressure," or (as KAHLENBERG prefers) "chemical affinity." In measuring osmotic pressures (for which he devised a new apparatus), stirring the liquids is absolutely essential—a factor not previously reckoned with; and in his experiments these measurements show such unlike pressures with the same substances when different membranes are used, and such changes with different temperatures that he holds them irreconcilable with the theory that, as a general rule, solutes conform to the behavior of gases, however closely some in water may do this. The paper deserves the closest attention from every physiologist; yet the weighty evidence against KAHLENBERG'S conclusions must not be forgotten.—C. R. B.

The vitality of buried seeds.—DUVEL gives a preliminary account of experiments on the vitality of buried seeds,[34] of some of the common economic plants and weeds of the United States, representing 109 species, 84 genera, and 34 families. In December, 1902, eight to twelve lots of each species of seeds were buried at three depths: 15–20, 46–56, 90–105 ^{cm}. A sample of each is to be taken up at given periods and tested for vitality along with controls stored in a dry place.

Tests up to date show the following results. In some cases none of either the controls on the buried seeds grow. Among these are: *Axyris amaranthroides*, *Bursa bursa-pastoris*, *Polygonum pennsylvanicum*, *P. persicaria*, *P. scandens*.

33 KAHLENBERG. L., On the nature of the process of osmosis and osmotic pressure, with observations concerning dialysis. Journ. Phys. Chem. 10:141–209. 1906. Published also in Trans. Wis. Acad. 15:209–272. 1906.

34 DUVEL, J. W. T., Vitality of buried seeds. Bureau Plant Industry Bull. 83. pp. 22. *pls.* 3. 1905.

A second group, among which are the common cereals and various other plants, as *Lactuca sativa*, *Helianthus annuus*, *Asparagus officinalis*, *Pinus virginiana*, *Robinia pseudacacia*, either all decayed before germinating or germinated and then all decayed before being examined. A third group, which includes our more noxious weeds, retained their vitality to a considerable degree. The deeper the seeds were buried the better they retained their vitality. Vitality is best preserved, even in weed seeds, when they are carefully harvested and stored in a dry and comparatively cool place.—WM. CROCKER.

Prothallia and sporelings of Botrychium.—BRUCHMANN[35] has been investigating *Botrychium Lunaria*. Since this species has no means of vegetative multiplication, like the adventitious shoots of *Ophioglossum vulgatum*, every sporophyte must have come from a gametophyte. The prothallia are hard to find because they are very small (1–2^{mm} long and 0.5–1^{mm} wide), and the sporelings grow for several years before they reach the surface of the soil. The prothallia are found at a depth of 1–3^{cm}. In form and general character the prothallium of *B. Lunaria* resembles that of *B. virginianum*, except that it is much smaller. BRUCHMANN succeeded in germinating the spores and his results agree with those of CAMPBELL, who got the two and three-cell stage in *Ophioglossum vulgatum*. Further work upon this aspect of the problem will be published later. However, he represents a single cell at the "spore pole" of the prothallium and regards this as the first cell of the prothallium, representing the protonema stage. Nearly every prothallium bears an embryo and some prothallia have two. The first division of the embryo is transverse. Growth is very slow, the sporeling being three years old before it reaches the surface. One plate and considerable attention in the text is devoted to the anatomy of the mature plant.—CHARLES J. CHAMBERLAIN.

Spermatozoids of Cycas revoluta.—MIYAKE[36] studied the living spermatozoids at the island of Oshima (28° 30′ N) in September, and in southern Japan (31° 35 N) from the beginning to the middle of October. The diameter of the spermatozoids varies from 180 to 210 μ. The two spermatozoids are surrounded by a delicate membrane, but it could not be determined with certainty whether the membrane belongs to the spermatozoid or is merely the *Hautschicht* of the protoplasm of the pollen tube. For observing the movements the spermatozoids were placed in a 10 per cent. cane sugar solution. The movements often continued for one to three hours; and in one case for six hours and forty minutes, and in another case for five hours and thirty minutes. In some cases the spermatozoids were shot out suddenly from the pollen tube, which seems to be the method that occurs under natural conditions. The forward movement is always accompanied by a rotation from left to right about the

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35 BRUCHMANN, H., Ueber das Prothallium und die Sporenpflanze von *Botrychium Lunaria* Sw. Flora **96**:203–230. *pls. 1–2.* 1906.

36 MIYAKE, Ueber die Spermatozoiden von *Cycas revoluta*. Ber. Deutsch. Bot. Gesell. **24**:78–83. *pl. 6.* 1906.